REMARKS

Claims 1-26 are all the claims presently pending in the application. The title, abstract and claims 1, 7, 9, 12, 14, 19-20 and 25 are amended to more clearly define the invention. Claims 1, 7, 14, and 20 are independent.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicant also notes that, notwithstanding any claim amendments herein or later during prosecution, Applicant's intent is to encompass equivalents of all claim elements.

Claims 1-12, and 14-25 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Akasaka et al. reference (U.S. Patent No. 6,292,288) in view of the Kosaka et al. reference (U.S. Patent No. 6,229,936). Claims 7-13, and 20-26 stand rejected under 35 U.S.C. § 103(a) as being obvious over the Deguchi et al. reference (U.S. Patent No. 6,075,633) in view of the Akasaka et al. reference (U.S. Patent No. 6,292,288) and in further view of the Kosaka et al. reference (U.S. Patent No. 6,229,936).

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

A first exemplary embodiment of the claimed invention, as defined by independent claim 1, is directed to an optical communication system for amplifying an optical signal propagating through an optical transmission line by using an optical amplifier in an optical repeater and emitting an amplified optical signal to an optical transmission line mounted at a back stage. The system includes a transmission line compensating device to generate control

light for producing a Raman amplification effect within the optical transmission line that is outside of the optical repeater based on a control signal superimposed on the optical signal.

A second exemplary embodiment of the claimed invention, as defined by independent claim 7, is directed to an optical communication system for amplifying an optical signal propagating through an upward transmission line or a downward transmission line by using a corresponding optical amplifier in an optical repeater and sending an amplified optical signal to an upward transmission line or a downward transmission line mounted at a back stage. The system includes transmission line compensating devices each operating for the upward transmission line or the downward transmission line and each generating, based on a control signal superimposed on the optical signal, control light which causes a Raman amplification effect in the optical transmission lines that are outside of the optical repeater.

A third exemplary embodiment of the claimed invention, as defined by independent claim 14, is directed to an optical repeater for amplifying an optical signal propagating through an optical transmission line by using an optical amplifier and sending an amplified optical signal to an optical transmission line mounted at a back stage. The optical repeater includes a transmission line compensating device to generate, based on a control signal superimposed on the optical signal, control light which causes a Raman amplification effect within the optical transmission line that is outside of the optical repeater.

A fourth exemplary embodiment of the claimed invention, as defined by independent claim 20, is directed to an optical repeater for amplifying an optical signal propagating through an upward transmission line or a downward transmission line by using a corresponding optical amplifier and sending an amplified optical signal to an upward transmission line mounted at a back stage or a downward transmission line mounted at a back

stage. The optical repeater includes transmission line compensating devices each operating for the upward transmission line or the downward transmission line and each generating, based on a control signal superimposed on the optical signal, control light which produces a Raman amplification effect within the upward transmission line or the downward transmission line outside of the optical repeater.

Conventional optical communication systems have optical signal characteristics which are affected by leakage of pumping light emitted from an optical repeater and a loss spectrum that is exhibited intrinsically by the optical transmission line.

Moreover, as the number of wavelength-multiplexed signals increase, it becomes more difficult to properly calibrate a difference in output of each signal only using an end terminal device.

In stark contrast, the present invention does not rely only upon end terminal devices. Rather, the present invention provides an optical repeater which provides a control light that produces a Raman amplification effect within the optical transmission lines that are outside of the optical repeater.

In this manner, the present invention may easily calibrate wavelength-multiplexed signals by providing a control light which enables the loss spectrum that is exhibited by the optical transmission lines to be compensated by the Raman amplification effect that is being produced while the control light propagates through the optical transmission line.

II. THE PRIOR ART REJECTION

A. The Akasaka et al. reference in view of the Kosaka et al. reference

The Examiner alleges that the Kosaka et al. reference would have been combined with

the Akasaka et al. reference to form the claimed invention. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to completely different matters and problems.

Specifically, the Akasaka et al. reference is directed to a Raman amplification method that is capable of uniformly amplifying wavelength division multiplexed signals without requiring a gain flattening filter and for use with an Er doped fiber amplifier (col. 4, lines 22-32).

In stark contrast, the Kosaka et al. reference is specifically directed to providing an optical amplifier that does not suffer from optical signal damage from optical components (such as an optical isolator, a wavelength divider, a coupler and the like) at a front stage such that it is difficult to keep the noise signal below 6 decibels (col. 1, lines 26 - 58) or which employ the use of a dispersion compensator (col. 1, line 59 - col. 2, line 7) without requiring the distance between optical repeaters to become too short (col. 2, lines 8 - 39) and without requiring a large number of pumping light sources (col. 2, lines 40-45). Therefore, one of ordinary skill in the art who was concerned with providing a Raman amplifier that can uniformly amplify wavelength division multiplexed signals as disclosed by the Akasaka et al. reference would not have referred to the Kosaka et al. reference because it is only concerned with the completely different and unrelated problems of providing an optical amplifier that does not suffer from optical signal damage from optical components (such as an optical isolator, a wavelength divider, a coupler and the like) at a front stage such that it is difficult to

keep the noise signal below 6 decibels or which employ the use of a dispersion compensator without requiring the distance between optical repeaters to become too short and without requiring a large number of pumping light sources. Thus, the references would <u>not</u> have been combined, <u>absent hindsight</u>.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner does not even support the combination by identifying a reason for combining the references.

The Examiner alleges that it would have been obvious to one of ordinary skill in the art to modify the Raman amplifier that is disclosed by the Akasaka et al. reference such that the Raman amplifier is controlled by a control signal that is superimposed on a main optical signal "because the monitor information generated by the optical transmission equipment (e.g., via supervisory/controller portion 50 of Fig. 1) contains information instructing change of amplification factor of the optical amplifier (col. 7, lines 19-22)."

However, the Examiner appears to be overlooking the fact that the Kosaka et al. reference discloses an optical amplifier 10A which includes doped optical fibers 1A, 1B, and 1C and that the supervisor/controller 50 controls the pumping light source 2 that amplifies the optical signal and that it is the supervisor signal that contains the information that instructs a change in the output of the pumping light source 2 that provides the change in amplification factor. In other words, the supervisory signal controls how much light is output from the pumping light source 2 <u>in the optical amplifier</u> 10A (col. 7, lines 16-35).

In stark contrast, the Akasaka et al. reference discloses an optical repeater (Fig. 10) that includes <u>a Raman amplifier</u> 9 <u>and</u> <u>Erbium doped fiber amplifiers</u> 10. Therefore, the Akasaka et al. reference does not teach or suggest <u>an optical amplifier which includes any</u>

pumping light source, let alone a pumping light source which might benefit from being controlled by a supervisory signal that is multiplexed with the main signal. Rather, only the Raman amplifier 9 appears to include semiconductor lasers 3 (Fig. 1).

Additionally, while the Kosaka et al. reference discloses providing a supervisory signal that is multiplexed with a main optical signal to control the amplification factor of the optical amplifiers, the Kosaka et al. reference does not explain why an optical transmission system, which includes such a supervisory signal has any advantage at all over an optical transmission system that does not.

Indeed, the Kosaka et al. reference is not at all concerned with the supervisory signal and why the supervisory signal is present. Rather, the Kosaka et al. reference is merely concerned with improving an optical amplifier and merely assumes that the supervisor signal is present.

Therefore, the Examiner's alleged motivation is not only irrelevant and inapplicable to the Akasaka et al. reference, but the Examiner's alleged motivation does not provide one of ordinary skill in the art with any reason to provide a supervisory signal.

Further, the Examiner alleges that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the Raman amplification method that is disclosed by the Akasaka et al. reference to replace the pumping light with the "control light as taught by Kosaka (sic) . . . because Kosaka (sic) suggests, in Col. 3, lines 49-57, that with this construction, the feeble optical signal, which is weakened on the transmission path due to propagation, is amplified without deterioration in the noise figure while optical fibers for amplifying are pumped, thereby achieving an optical transmission equipment being economical and small-sized with a low electric power consumption."

Firstly, contrary to the Examiner's allegation, the Kosaka et al. reference does not teach or suggest a "control light." Indeed, nothing at all within the Kosaka et al. reference even mentions a "control light." Therefore, the Kosaka et al. reference clearly does not disclose a "control light."

Secondly, regardless of whether or not the Kosaka et al. discloses a "control light," the Examiner's citation of col. 3, lines 49-57 is taken completely out of context and the advantages which are listed in this citation have absolutely nothing to do with any "control light."

Rather, col. 3, lines 49-57 of the Kosaka et al. reference is only relevant to "the construction mentioned above" (col. 3, line 49). The "construction mentioned above" is referring to the optical transmission equipment that is described at col. 3, lines 26-48. Careful examination of the description of this optical transmission equipment reveals absolutely no mention at all of any "control light."

Further, the advantages which are listed by the Examiner's citation at col. 3, lines 49-57 are achieved by the optical equipment that is illustrated by Fig. 1 because "there is provided no such optical parts, for example the optical isolator or the like, that brings a large signal loss, at the initial stage of the optical amplifier 10A, it is possible to achieve the optical amplifier and the optical transmission (sender) equipment having a low NF therein." (Col. 7, lines 36-41). More specifically, the optical isolator is necessary to be provided in the front stage in front of the doped fiber 1B, however, even with the doped fiber 1A before the optical isolator the incident or input signal receives no ill effect on it, in particular, in the noise thereof, since the incident or input signal to the optical isolator is already amplified once (col. 7, lines 42 - 55).

Therefore, the Examiner's alleged motivation not only has absolutely nothing to do with any "control light" which is not disclosed by any of the applied references, but the alleged motivation that the Examiner attempts to rely upon as a reason to provide such an undisclosed "control light" is attributed by the source of the Examiner's motivation (the Kosaka et al. reference) to be the result of the doped fiber 1A being positioned before the optical isolator 6 in the optical amplifier.

Therefore, contrary to the Examiner's allegations one of ordinary skill in the art at the time the invention was made would not have combined these references.

Moreover, even assuming arguendo that one of ordinary skill in the art would have been motivated to combine these references, the combination would not teach or suggest each and every element of the claimed invention.

None of the applied references teaches or suggests the features of the present invention including a transmission line compensating device that generates a control light for producing a Raman amplification effect within the optical transmission line that is outside of the optical repeater. As explained above, this feature is important for easily calibrating wavelength-multiplexed signals by providing a control light which enables the loss spectrum that is exhibited by the optical transmission lines to be compensated by the Raman amplification effect that is being produced while the control light propagates through the optical transmission line.

Rather, in stark contrast, the Akasaka et al. reference discloses a Raman amplifier that is entirely contained within an optical repeater. The Akasaka et al. reference illustrates an optical repeater in Fig. 10 which includes a Raman amplifier 9. The Raman amplifier is illustrated in detail in Fig. 1. The Akasaka et al. reference clearly explains that an input

optical signal is incident on the amplifier fiber 2 from the optical signal input fiber 12 and is then combined with the pumping light of the pumping means in the amplifier fiber 2 to be Raman amplified. (Col. 13, lines 49 - 55).

The Akasaka et al. reference further explains that the amplifier fiber may be a special fiber suitable for Raman amplification or may be an extension of the signal input fiber 12 by which the optical signal is received (col. 13, line 64 - col. 14, line 1). In either case, all of the Raman amplification that is performed by the Raman amplifier that is disclosed by the Akasaka et al. reference <u>takes place entirely within the Raman amplifier which, in turn, is entirely within the optical repeater</u>. Therefore, the Raman amplifier that is disclosed by the Akasaka et al. reference does not teach or suggest producing a Raman amplification effect <u>within the optical transmission line that is outside of the optical repeater</u>.

The Kosaka et al. reference does not remedy the deficiencies of the Akasaka et al. reference. Indeed, the Kosaka et al. reference does not disclose anything at all relating to Raman amplifiers.

Therefore, the Examiner is respectfully requested to withdraw the rejection of claims 1-12, and 14-25.

B. The Deguchi et al. reference in view of the Kosaka et al. reference and in further view of the Akasaka et al. reference

The Examiner alleges that the Kosaka et al. reference would have been combined with the Deguchi et al. reference and further that the Akasaka et al. reference would have been combined with the combination of the Deguchi et al. reference and the Kosaka et al. reference to form the claimed invention. Applicant submits, however, that these references would not

have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to completely different matters and problems.

Specifically, the Deguchi et al. reference is directed to providing a light transmission system that has one or more repeating installations and a branching installation which branches an optical signal from the first terminal equipment to the third terminal equipment and transfers an optical signal from the third terminal equipment to the second terminal equipment and in which a supervisory control signal is accurately communicated from the terminal equipment to the repeating stations (col. 3, lines 7-17).

In stark contrast, as explained above, the Kosaka et al. reference is specifically directed to providing an optical amplifier that does not suffer from optical signal damage from optical components (such as an optical isolator, a wavelength divider, a coupler and the like) at a front stage such that it is difficult to keep the noise signal below 6 decibels (col. 1, lines 26 - 58) or which employ the use of a dispersion compensator (col. 1, line 59 - col. 2, line 7) without requiring the distance between optical repeaters to become too short (col. 2, lines 8 - 39) and without requiring a large number of pumping light sources (col. 2, lines 40-45). Therefore, one of ordinary skill in the art who was concerned with providing a light transmission system that has one or more repeating installations and a branching installation which branches an optical signal from the first terminal equipment to the third terminal equipment and transfers an optical signal from the third terminal equipment to the second terminal equipment and in which a supervisory control signal is accurately communicated

from the terminal equipment to the repeating stations as disclosed by the Deguchi et al. reference would not have referred to the Kosaka et al. reference because it is only concerned with the completely different and unrelated problems of providing an optical amplifier that does not suffer from optical signal damage from optical components (such as an optical isolator, a wavelength divider, a coupler and the like) at a front stage such that it is difficult to keep the noise signal below 6 decibels or which employ the use of a dispersion compensator without requiring the distance between optical repeaters to become too short and without requiring a large number of pumping light sources.

Further, in contrast to the Deguchi et al. reference and the Kosaka et al. reference, the Akasaka et al. reference is specifically directed to a Raman amplification method that is capable of uniformly amplifying wavelength division multiplexed signals without requiring a gain flattening filter and for use with an Er doped fiber amplifier (col. 4, lines 22-32). Therefore, one of ordinary skill in the art who was concerned with providing a light transmission system that has one or more repeating installations and a branching installation which branches an optical signal from the first terminal equipment to the third terminal equipment and transfers an optical signal from the third terminal equipment to the second terminal equipment and in which a supervisory control signal is accurately communicated from the terminal equipment to the repeating stations as disclosed by the Deguchi et al. reference or who was concerned with the problems of providing an optical amplifier that does not suffer from optical signal damage from optical components (such as an optical isolator, a wavelength divider, a coupler and the like) at a front stage such that it is difficult to keep the noise signal below 6 decibels or which employ the use of a dispersion compensator without requiring the distance between optical repeaters to become too short and without requiring a

large number of pumping light sources as disclosed by the Kosaka et al. reference would not have referred to the Akasaka et al. reference because that reference is concerned with the completely different and unrelated problem of providing a Raman amplification method that is capable of uniformly amplifying wavelength division multiplexed signals without requiring a gain flattening filter and for use with an Er doped fiber amplifier. Thus, the references would not have been combined, absent hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner does not even support the combination by identifying a reason for combining the references.

Even assuming arguendo that one of ordinary skill in the art would have been motivated to combine these references, the combination would not teach or suggest each and every element of the claimed invention.

None of the applied references teaches or suggests the features of the present invention including a transmission line compensating device that generates a control light for producing a Raman amplification effect within the optical transmission line that is outside of the optical repeater. As explained above, this feature is important for easily calibrating wavelength-multiplexed signals by providing a control light which enables the loss spectrum that is exhibited by the optical transmission lines to be compensated by the Raman amplification effect that is being produced while the control light propagates through the optical transmission line.

The Deguchi et al. reference clearly does not teach or suggest this feature. Indeed, the Kosaka et al. reference does not disclose anything at all relating to Raman amplifiers, let alone calibrating wavelength-multiplexed signals by providing a control light which enables

the loss spectrum that is exhibited by the optical transmission lines to be compensated by the Raman amplification effect that is being produced <u>while the control light propagates through the optical transmission line</u>.

The Kosaka et al. reference and the Akasaka et al. reference does not remedy the deficiencies of the Deguchi et al. reference.

Therefore, the Examiner is respectfully requested to withdraw the rejection of claims 7-13 and 20-26.

III. FORMAL MATTERS AND CONCLUSION

The Office Action objects to the Abstract, the Title and claim 9. This Amendment amends the Title, the Abstract and claim 9 in accordance with Examiner Chan's very helpful suggestions. Applicant respectfully requests withdrawal of these objections.

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 1-26, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 12/30/03

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